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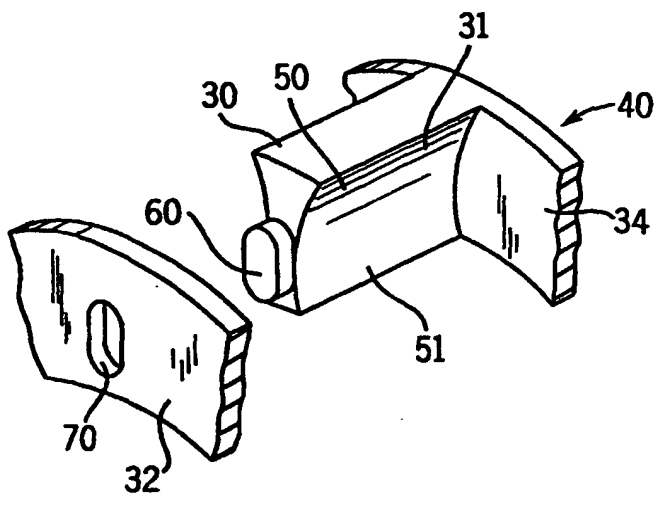
(54) Title: CYLINDRICAL BEARING HAVING A TWO-PIECE CAGE CONFIGURATION WITH A DUAL GOTHIC ARCH POCKET GEOMETRY



(57) Abstract: The present invention is an improved cage for use in guiding rollers within a roller bearing. The cage includes a spacer bar assembly having a plurality of spacer bars (30) that extend axially from a first integral endplate (34). The spacer bar assembly is secured to a second similarly shaped end plate (32) to form a two-piece cage. The spacer bars have opposing sides (31) and the areas between the sides of adjacent spacer bars define pockets that are adapted to receive the rollers. Each pocket in the two-piece cage has a dual gothic arch configuration.

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CYLINDRICAL BEARING HAVING A TWO-PIECE CAGE CONFIGURATION WITH A DUAL GOTHIC ARCH POCKET GEOMETRY

FIELD OF THE INVENTION

This invention relates to a roller bearing, and more particularly to an improved cage for a roller bearing.

BACKGROUND OF THE INVENTION

Roller bearings include cages (i.e., retainers) which separate, guide and position the cylindrical rollers within the bearing. A typical cage includes axially extending spacer bars that separate and restrain each of the rollers. The individual spacer bars are connected at opposite ends to annular endplates. The endplates provide support to the spacer bars and prevent the rollers from moving axially.

There are two types of cages used in conventional roller bearings. The first type of cage is referred to as a two-piece cage because in this type of cage one end of each spacer bar is integral with one of the end plates and the other end is secured (e.g., by riveting or staking) to the other end plate. The second type of cage is referred to as a segmented, or multi-piece, cage because the spacer bars used in the cage are secured at opposite ends to separate end plates. The end plates are secured to the spacer bars in any conventional manner, including but not limited to, welding, staking, riveting or the like.

In both types of cages the spacer bars include opposing sides. The area between the sides of adjacent spacer bars defines a pocket that is adapted to receive one of the rollers. The pocket geometry is slightly larger than the diameter of the rollers and surrounds substantially the entire roller. Each roller extends through an interior portion of the cage such that the rollers are in contact with, and rotate relative to, an inner race. In addition, each roller extends through an exterior portion of the cage such that the rollers are in contact with, and rotate relative to, an outer race.

The pocket geometry of a two-piece cage is substantially cylindrical, but the pocket geometry in segmented cages can be either cylindrical or a dual gothic arch configuration. A dual gothic arch pocket geometry provides positive contact between the cage and roller at locations above and below the pitch diameter of the rollers.

SUMMARY OF THE INVENTION

The present invention includes an improved bearing cage for use in guiding rollers within a roller bearing. The cage includes a spacer bar assembly having a plurality of spacer bars that are integral with and extend perpendicular from a first end plate. The spacer bar assembly is secured to a second similarly shaped endplate to form a two-piece cage. The spacer bars have opposing sides and the areas between the sides of adjacent spacer bars define pockets that are adapted to receive the rollers. The opposing sides of each spacer bar have a gothic arch configuration that allows for longitudinal line contact along rollers. The dual gothic arch pocket geometry in the two-piece cage provides improved roller guidance during high-speed operation of the bearing. Increased performance results from the superior structural integrity provided by the two-piece bearing cage and exceptional roller guidance provided by the dual gothic arch pocket geometry.

In one form of the invention, the bearing cage is comprised of bronze. It has been found that bronze bearing cages with a dual gothic arch pocket geometry and two-piece cages with a dual gothic arch pocket geometry perform quieter and run at lower steady-state temperatures.

In another form of the invention, the spacer bar assembly is secured to the second end plate by press-fitting projections located on the ends of at least some of the spacer bars within corresponding openings in the second end plate. The openings in the second end plate are elliptical (in one form) and are adapted to receive corresponding elliptical projections on the exposed ends of one or more spacer bars. The second end plate is assembled to the spacer bar assembly by staking (i.e., cold-forming) the projections against an outer surface of the second end plate. The projections on the spacer bars and the corresponding openings in the end plates are less expensive to assemble than prior art techniques and provide a superior connection.

Other features and advantages of the invention will become apparent to those skilled in the art upon review of the following detailed description, claims and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a front view of a partially secti ned cylindrical roller bearing embodying the present invention.

Fig. 2 is a cross-section view of the cylindrical roller bearing of Fig. 1 taken along line 2-2.

Fig. 3 is a cross-section view of the cylindrical roller bearing of Fig. 2 taken along line 3-3.

Fig. 4 is a partially sectioned front view of a cage used in the cylindrical roller bearing of Fig. 1.

Fig. 5 is a partially sectioned right side view of the bearing cage of Fig. 4.

Fig. 6 is a perspective view of a spacer bar with a second end plate attached to the spacer bar assembly.

Fig. 7 is a perspective view of a spacer bar with a second end plate detached from the spacer bar assembly.

Fig. 8 is a section view of the bearing of Fig. 1 taken along line 8-8.

Fig. 9 is a section view similar to Fig. 8 with the projections on the spacer bar assembly staked against the outside surface of the second end plate.

DETAILED DESCRIPTION

One form of a cylindrical roller bearing that encompasses the present invention is shown in Fig. 1, although any known roller bearing could be modified to incorporate the present invention. The cylindrical roller bearing 10 includes a two-piece cage 12, an inner ring 14, an outer ring 16 and a plurality cylindrical rollers 20.

As shown most clearly in Figs. 2 and 3, the rollers 20 are secured inside the cage 12 between spacer bars 30 and end plates 32, 34. The rollers 20 are positioned within the cage 12 such that the longitudinal axis of each roller 20 is oriented in a circular configuration about the longitudinal axis of the bearing 10. The diameter of the circular configuration for the longitudinal axes of the rollers 20 is hereafter referred to as the pitch diameter.

The two-piece cage 12 is shown most clearly in Figs. 4-7. The cage 12 is preferably made from bronze and includes a spacer bar assembly 40 that is secured to a second end plate 32. The spacer bar assembly 40 includes the spacer bars 30 which extend axially from an integral first end plate 34. Each spacer bar 30 includes opposing sides 31

that have a gothic arch design. The area between the opposing sides of adjacent spacer bars 30 defines a pocket that is adapted to receive a roller 20. The outer, or contact surface, of each cylindrical roller 20 is supported within the pocket. The rollers 20 extend from the pocket toward an interior portion of the cage 12 such that the rollers 20 are in rotating contact with an inner race 22 on the inner ring 14 (see Figs. 1 and 3). In addition, the rollers 20 extend outwardly from the pocket toward an exterior portion of the cage 12 such that the rollers 20 are in rotating contact with an outer race 24 on the outer ring 16.

The gothic arch configuration of each opposing side 31 on the spacer bars 30 provides dual arcuate contact surfaces 50, 51 that serve to partially constrain the rollers 20 within the cage 12. One of the arcuate contact surfaces 50 is located above the pitch diameter of the rollers 20 while the other arcuate contact surface 51 is located below the pitch diameter of the rollers 20 (see Figs 6 and 7).

In one embodiment of the invention, the spacer bar assembly 40 is secured to the first end plate 32 by press fitting a projection 60 on the exposed ends of the spacer bars 30 into corresponding openings 70 in the first end plate 32. As shown most clearly in Figs. 6-9, each projection 60 extends past an outer surface 63 of the first end plate 32 such that each projection 60 is staked against the outer surface 63 of the first end plate 32 (see Figs. 8 and 9). The major diameters of the elliptical projections 60 and the openings 70 are oriented radially with respect to the longitudinal axis of the bearing 10. The elliptical projections 60 extend through the openings 70 in the first end plate 32 until a shoulder 72 on the spacer bar 30 abuts an inside surface 64 on first end plate.

The projections 60 and the openings 70 are elliptical, although other configurations that effectively seal the spacer bar assembly 40 to the first end plate 32 may be used. Referring now particularly to Fig. 9, the elliptical openings 70 in the first end plate 32 include chamfered edges 71 that receive a portion of the projection material which is deformed during staking.

The present invention is not limited to the embodiments shown and described above, alternate embodiments will be apparent to those skilled in the art and are within the intended scope of the present invention. In particular, it will be apparent to one skilled in the art to utilize races and rolling elements of different configurations. Therefore, the invention should be limited only by the following claims.

What is claimed is:

1. A roller bearing comprising:

an inner ring having an inner race;

an outer ring encircling the inner ring, the outer ring having an outer race;

a bearing cage between the inner ring and the outer ring, the bearing cage including a spacer bar assembly having spacer bars extending axially from a first end plate, the spacer bar as being integrally joined to the first end plate, and a second end plate secured to the spacer bars and positioned in spaced apart parallel relation to the first end plate, wherein the spacer bars include opposing sides, each of the opposing sides having two arcuate portions formed in a gothic arch; and

a plurality of rollers housed within the opposing sides of the spacer bars such that the rollers are in rotatable contact with the opposing sides of the spacer bars, the inner race and the outer race.

2. The roller bearing of claim 1 wherein the cage is made from bronze.

3. The roller bearing of claim 1 wherein at least a plurality of the spacer bars include a projection such that each of the projections is press fit into openings in the second end plate.

4. The roller bearing of claim 3 wherein the projections are oval and the openings in the second end plate are oval.

5. The roller bearing of claim 3 wherein the projections are elliptical and the openings in the second end plate are elliptical.

6. The roller bearing of claim 5 wherein each of the elliptical projections and openings includes a radially extending major axis.

7. A roller bearing comprising:

an inner ring having an inner race;

an outer ring encircling the inner ring, the outer ring having an outer race;

a bronze cage including spacer bars, a first end plate and a second end plate, the spacer bars extending axially between the first end plate and the second end plate, wherein the spacer bars include opposing sides, each of the opposing sides including two arcuate portions that form a gothic arch; and

a plurality rollers housed within the opposing sides of the spacer bar such that the rollers are in rotatable contact with the opposing sides of the spacer bars, the inner race and the outer race.

8. The roller bearing of claim 7 wherein at least a plurality of the spacer bars include a projection on one end of the spacer bar such that each of the projections is press fit into openings in either the first end plate or the second end plate.

9. The roller bearing of claim 7 wherein the projections are oval and the corresponding openings in either the first end plate or the second end plate are oval.

10. The roller bearing of claim 8 wherein the projections are elliptical and the corresponding openings in either the first end plate or the second end plate are elliptical.

11. The roller bearing of claim 10 wherein each of the elliptical projections and openings includes a radially extending major axis.

12. The roller bearing of claim 8 wherein the projections extend from both ends of at least a plurality of the spacer bars.

13. A cage for securing rollers in a bearing, the cage comprising:

a spacer bar assembly including spacer bars extending axially from a first integral end plate, wherein the spacer bars include opposing sides having arcuate portions formed in gothic arch; and

a second end plate secured to the spacer bars.

14. The cage of claim 13 wherein the second end plate and the spacer bar assembly are made from bronze.

15. The cage of claim 14 wherein at least a plurality of the spacer bars include a projection that is press fit into an opening in the second end plate.

16. The cage of claim 15 wherein the projections are oval and the openings in the second end plate are oval.

17. The cage of claim 15 wherein the projections are elliptical and the openings in the second end plate are elliptical.

18. The cage of claim 17 wherein the elliptical projections and openings include a radially extending major axis.

19. A roller bearing comprising:

an inner ring having an inner race;

an outer ring encircling the inner ring, the outer ring having an outer race;

a cage including spacer bars, a first end plate and a second end plate, the spacer bars extending axially between the first end plate and the second end plate, wherein the spacer bars include opposing sides;

a plurality rollers housed within the opposing sides of the spacer bar such that the rollers are in rotatable contact with the opposing sides of the spacer bars, the inner race and the outer race; and

wherein at least a plurality of the spacer bars include an elliptical projection on one end of the spacer bar such that each of the elliptical projections is press fit into elliptical openings in either the first end plate or the second end plate.

20. The roller bearing of claim 19 wherein each of the elliptical projections and elliptical openings includes a radially extending major axis.

21. The roller bearing of claim 20 wherein the elliptical projections extend from both ends of at least a plurality of the spacer bars.

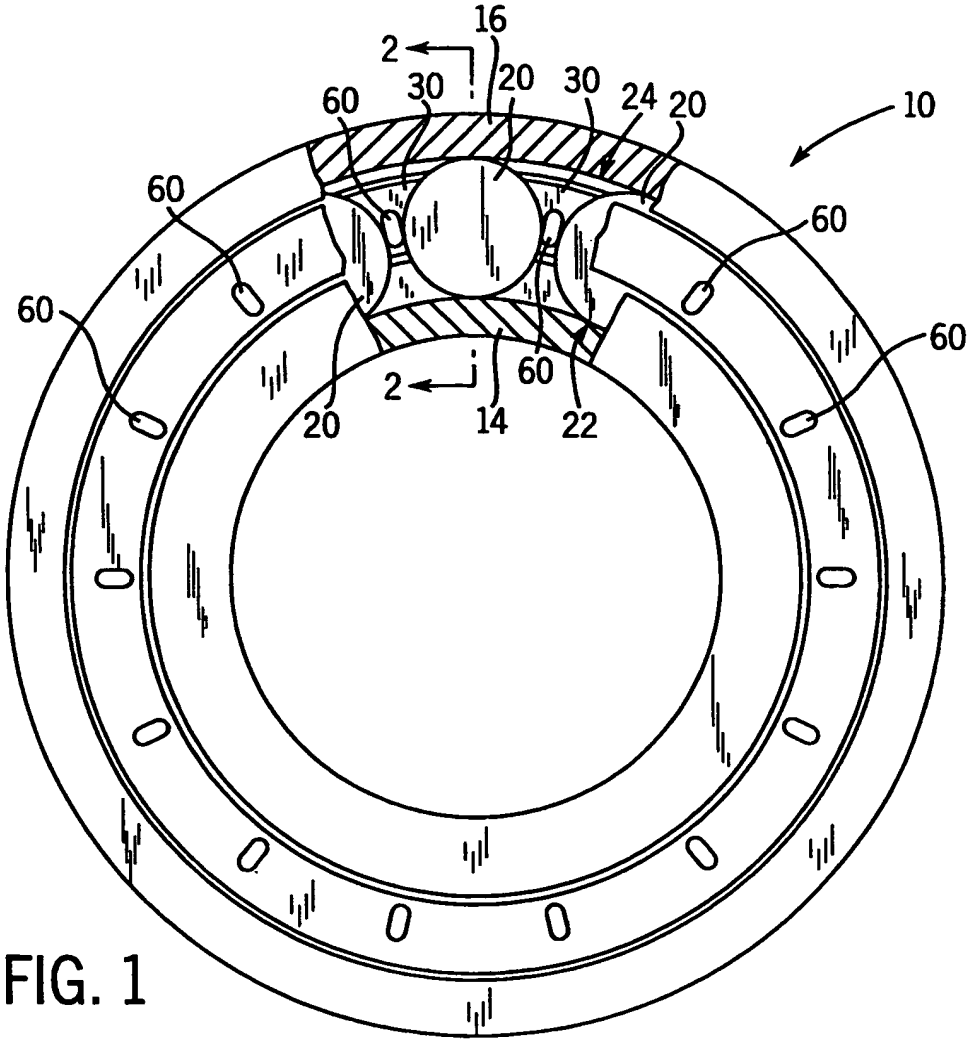

FIG. 1

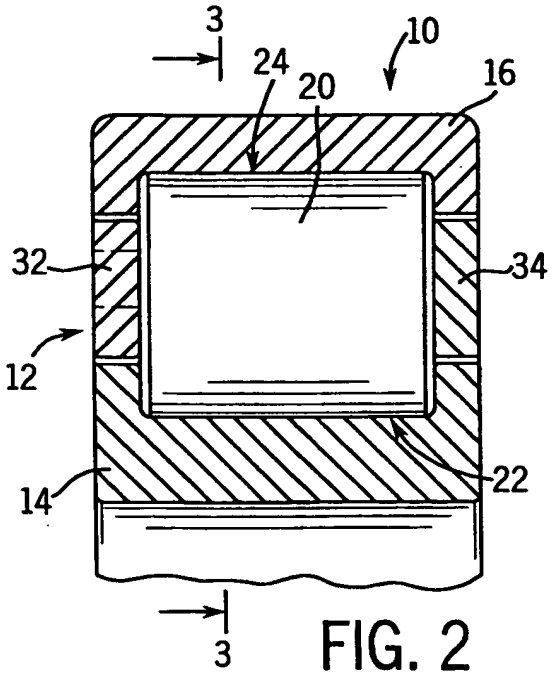

FIG. 2

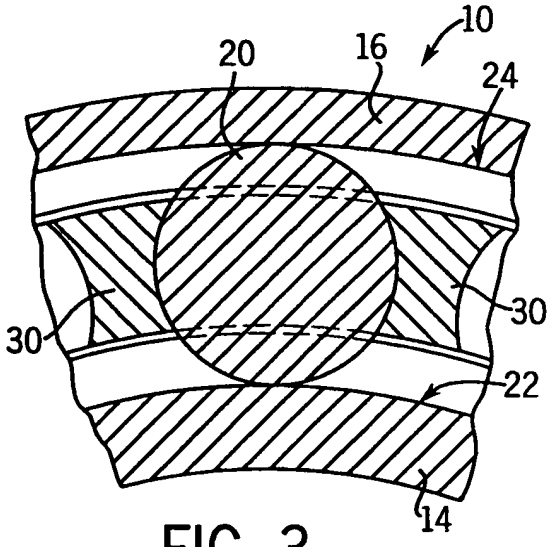

FIG. 3

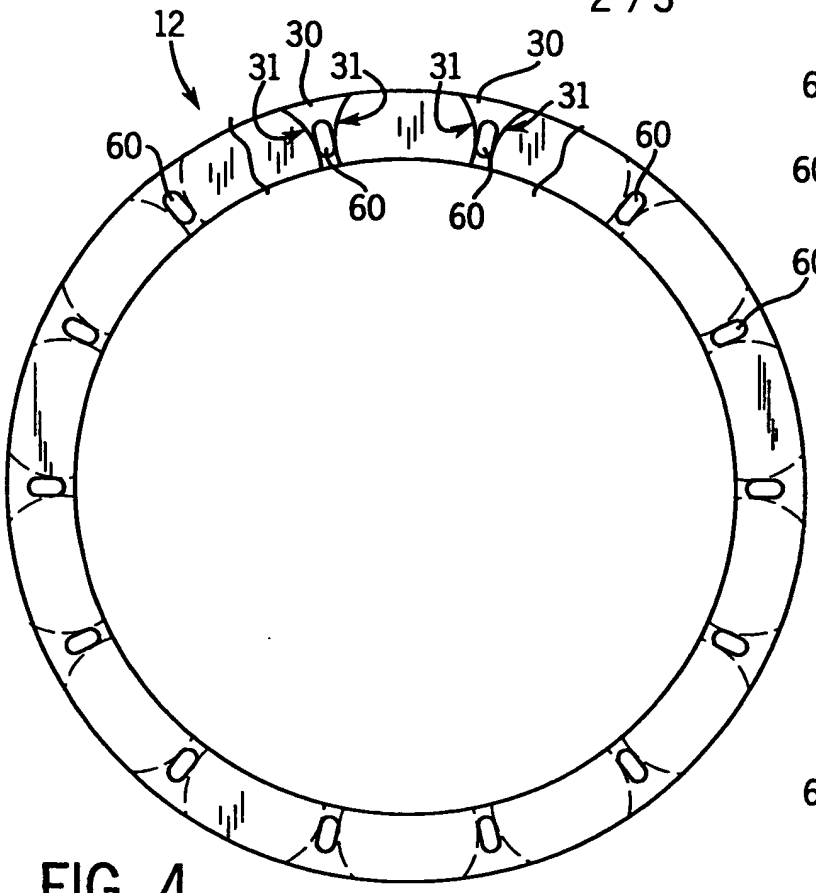

FIG. 4

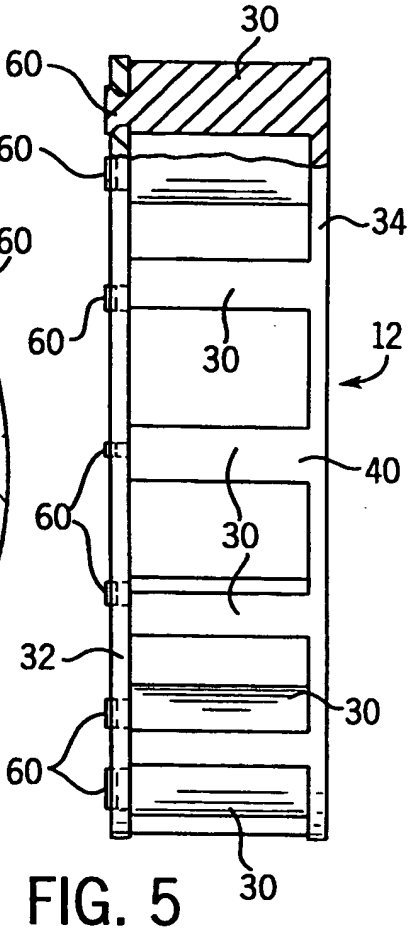

FIG. 5

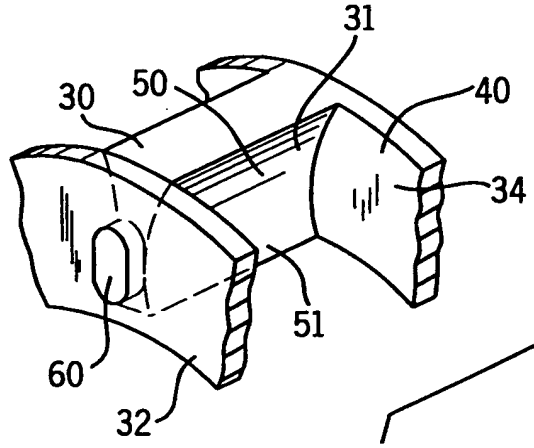

FIG. 6

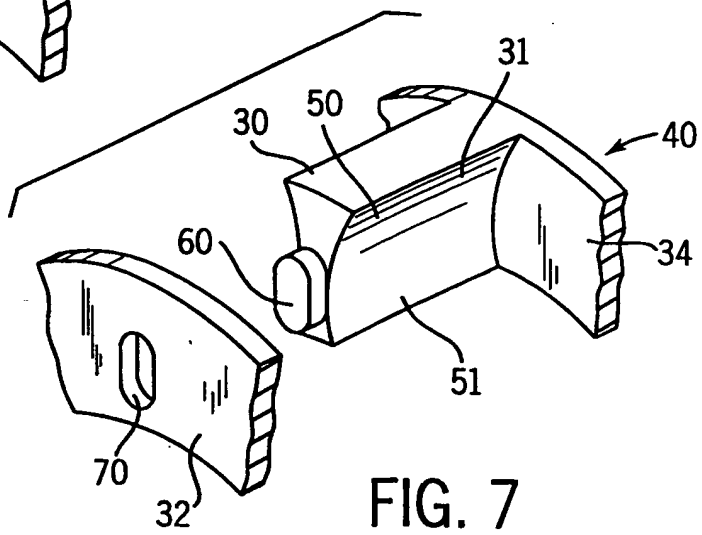

FIG. 7

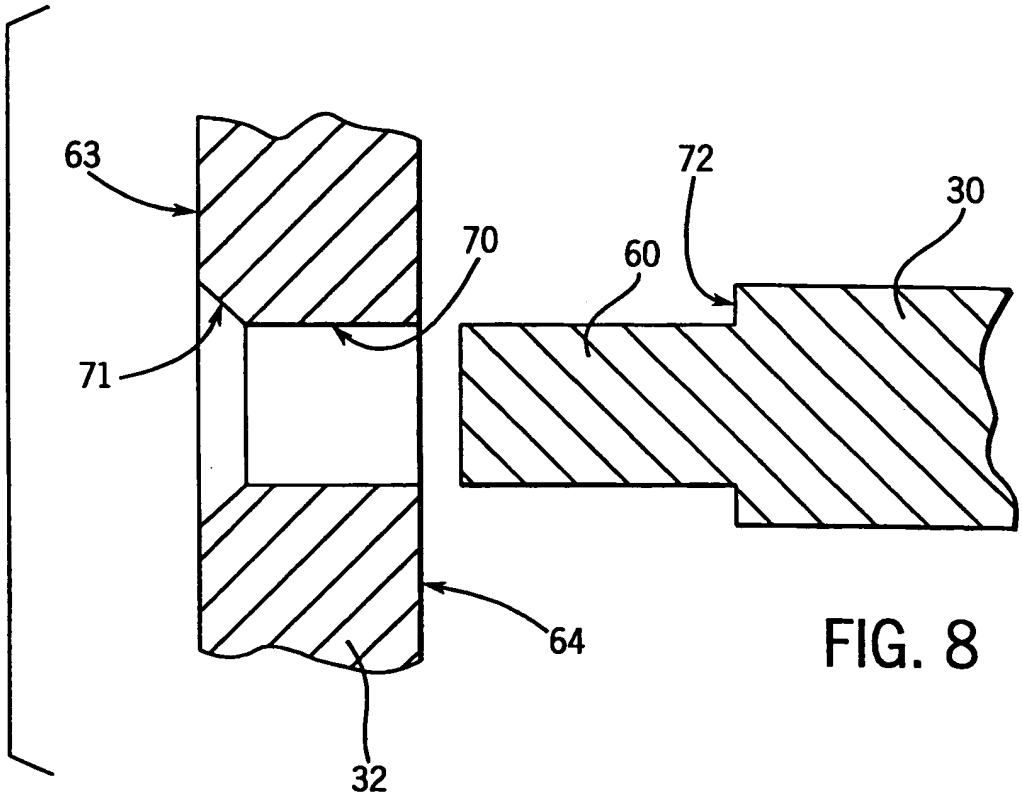

FIG. 8

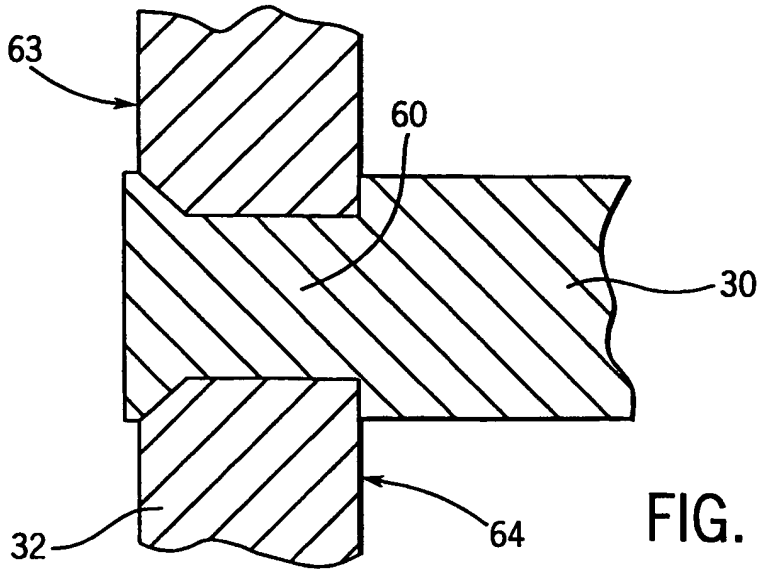

FIG. 9

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 00/27316

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F16C33/46

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F16C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	the whole document	2,15
X	US 3 944 307 A (BINGLE GERALD L) 16 March 1976 (1976-03-16)	1,13,19
A	the whole document	3-6, 15-18,20
X	DE 197 26 825 A (TORRINGTON CO) 8 January 1998 (1998-01-08) column 1, line 68	1,2
X	US 4 155 606 A (KISPERT KLAUS ET AL) 22 May 1979 (1979-05-22) the whole document	1,13

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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21 December 2000	29/12/2000

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INTERNATIONAL SEARCH REPORT

International Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Information on patent family members

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